PHOENIX CONTACT
SOUTHEAST ASIA

Protection for Process Industry

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Phoenix Contact Southeast Asia

Agenda

1. **Importance of Explosion Proof**
   - Safety Systems

2. **Hazardous Areas Basics**
   - Explosion Basics
   - Zone Classifications
   - Explosion Protection Concepts

3. **Handling Zone 0 Signals**
   - Intrinsic Safety

4. **Signal Conditioning**
   - Purpose Of Signal Conditioning

5. **Mini Analog Pro EX – Phoenix Contact Solution**

6. **Offshore Wellhead Application**

Most Devastating Industrial Accidents in American History

BP REFINERY EXPLOSION, TEXAS CITY

Introduction

BP Texas City Refinery Explosion (USA)

- 15 killed | 180+ injured | USD 1.5B+ losses

Esso Longford Gas Plant Explosion(Australia)

- 2 killed | Nationwide gas supply collapse

Pengerang Integrated Complex (Malaysia)

- 5 killed | 1 Seriously Injured | Startup Of Plant Delayed by 6-12 Months

Explosion Proof

Explosive Material

Flammable gases
(vapors, mists)
Flammable dusts

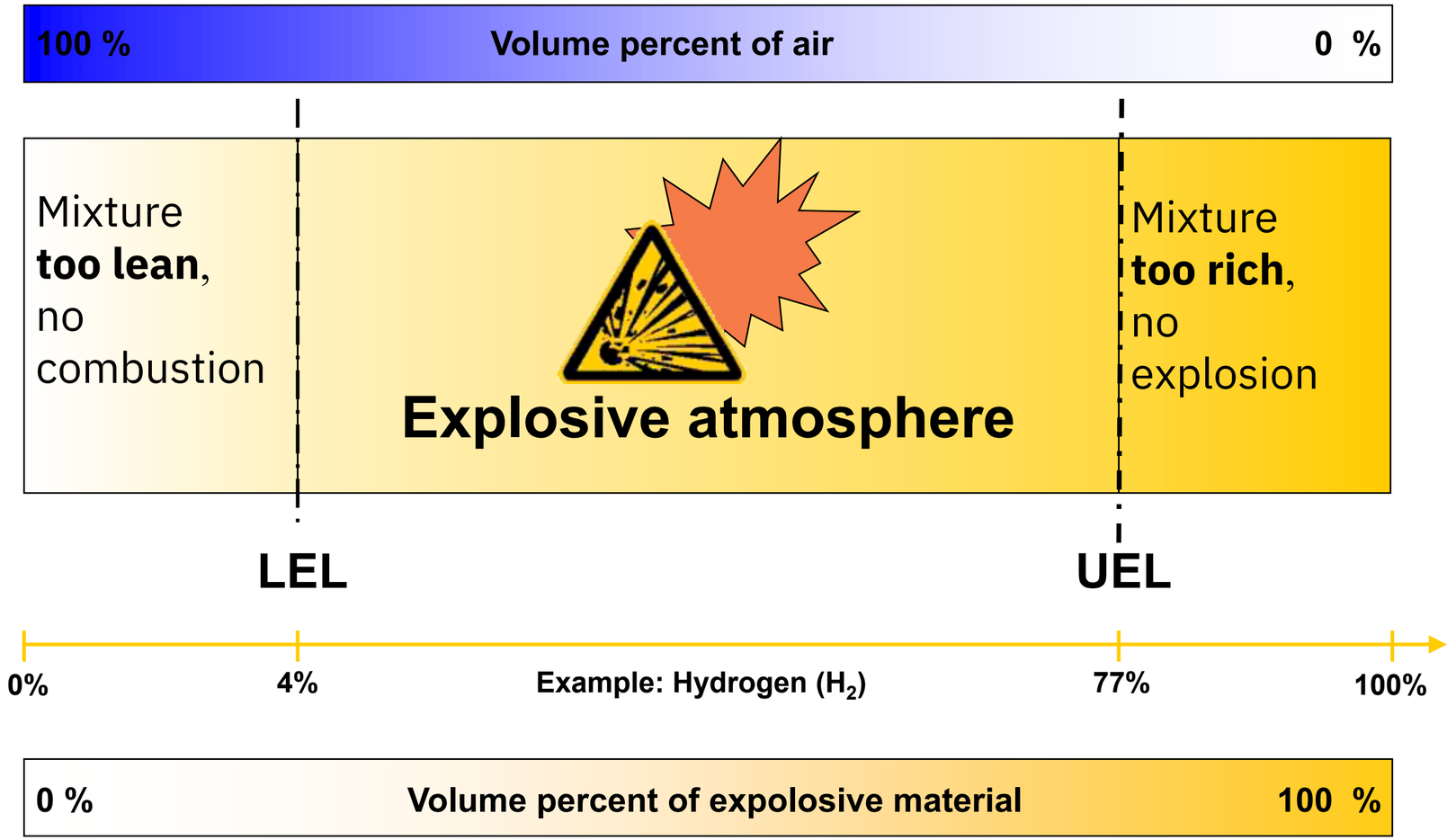
Oxygen

Oxygen from air,
Oxygen from chemical reactions

Source Of Ignition

Sparks, arcs, hot surfaces of electrical devices

Explosion Proof



ATEX Codes Breakdown Standard IEC 60079-0

Intrinsically safe equipment (Ex i field device)

ATEX — EN 60079

II 1 G Ex ia IIC T6

Equipment group:
I = underground mining
II = surface installations

Equipment category
1 = up to zone 0 / 20
2 = up to zone 1 / 21
3 = only zone 2 /21

Atmosphere
G: Gas
D: Dust

Method of protection
= intrinsic safety

Level of protection:
a = up to Zone 0 / 20
b = up to Zone 1 / 21
c = only Zone 2 / 22

Group
I = Mining installation
II = Surface installation - gas
III = Surface installation - dust

Temperature class T6 = max. surface temperature = 85°C

Group (of ignition energy)
A = e. g. propane (ignition energy >180 µJ)
B = e. g. ethylene (ignition energy > 60 µJ)
C = **e.g. hydrogen** (ignition energy > 20 µJ)

Associated equipment (Ex i isolator)

ATEX — EN 60079

II (1) G [Ex ia Ga] IIC

Bracket = Associated equipment

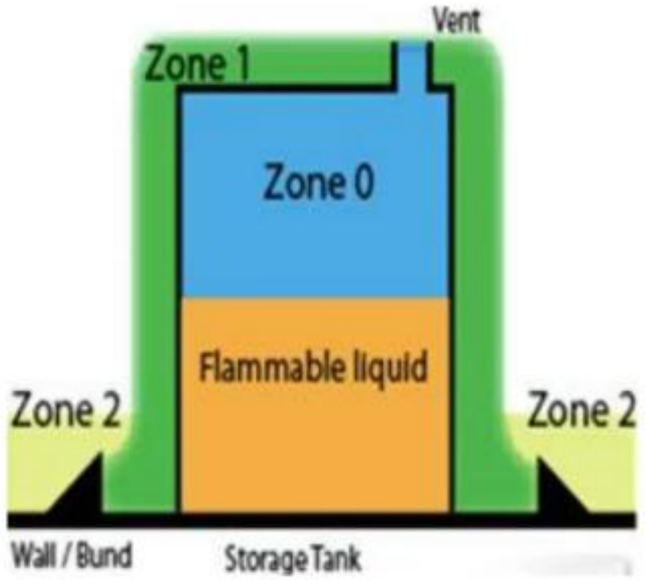
Considerations For ATEX

Gases For Consideration

Hydrogen | Hydrocarbons| Solvents

Maximum Allowable Surface Temperature

Temperature Class T1-T6



Hazordous Area Zoning

Zone 0 | Zone 1| Zone 2

ATEX /IECEx Certification

IEC / EN 60079

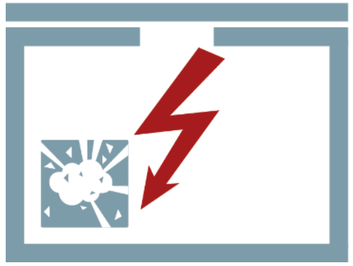
Why is Zone 0 So Difficult?

"Zone 0 environments… **are the most demanding**… requiring **zero ignition risk** under all operating and fault conditions."- IEC 60079

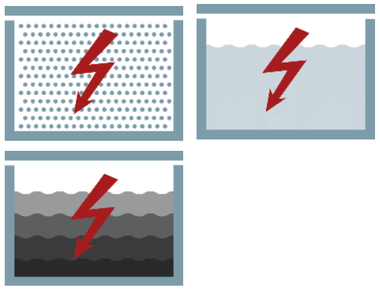
Key Challenges

- Safe Even Under 2 faults
- Require Intrinsic Safety (Ex Ia)
- No Room For Error
- Under Constant Danger

ATEX Classification

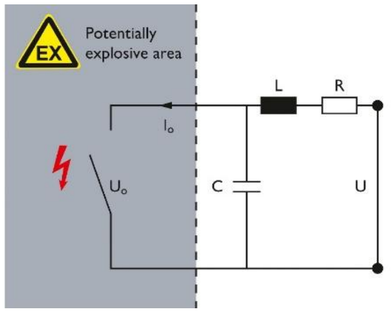


Ex d
Flame Proof Enclosure

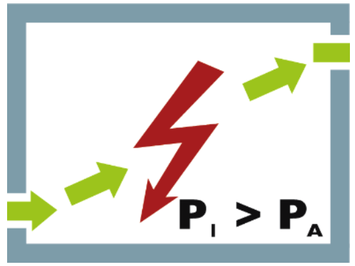


Ex m, Ex o, Ex q
Encapsulation, Powder or Oil Immersion

Ex e
Increased Safety

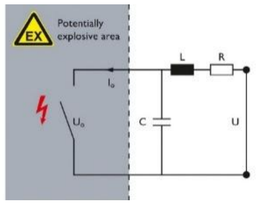


Ex i
Intrinsic Safety



Ex p
Pressurized

Intrinsic Safety

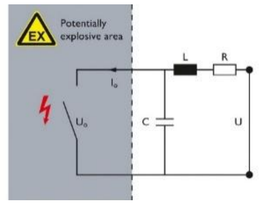


Ex i
Intrinsic Safety

limiting voltage	and at the same time
limiting current	and at the same time
limiting stored energy (capacitance and inductance)	

Intrinsic safety = limiting energy

Intrinsic Safety



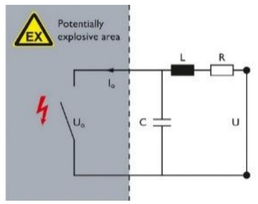
Ex i
Intrinsic Safety

“A circuit in which neither sparks nor thermal effects occur under the conditions determined in this standard comprising unhindered operation and certain failure conditions, able to provoke ignition of a certain explosive atmosphere.”

Quote from EN 60079-11, chapter 3.1.4

Intrinsic safety is marked with: Ex i

Benefits Of Intrinsic Safety



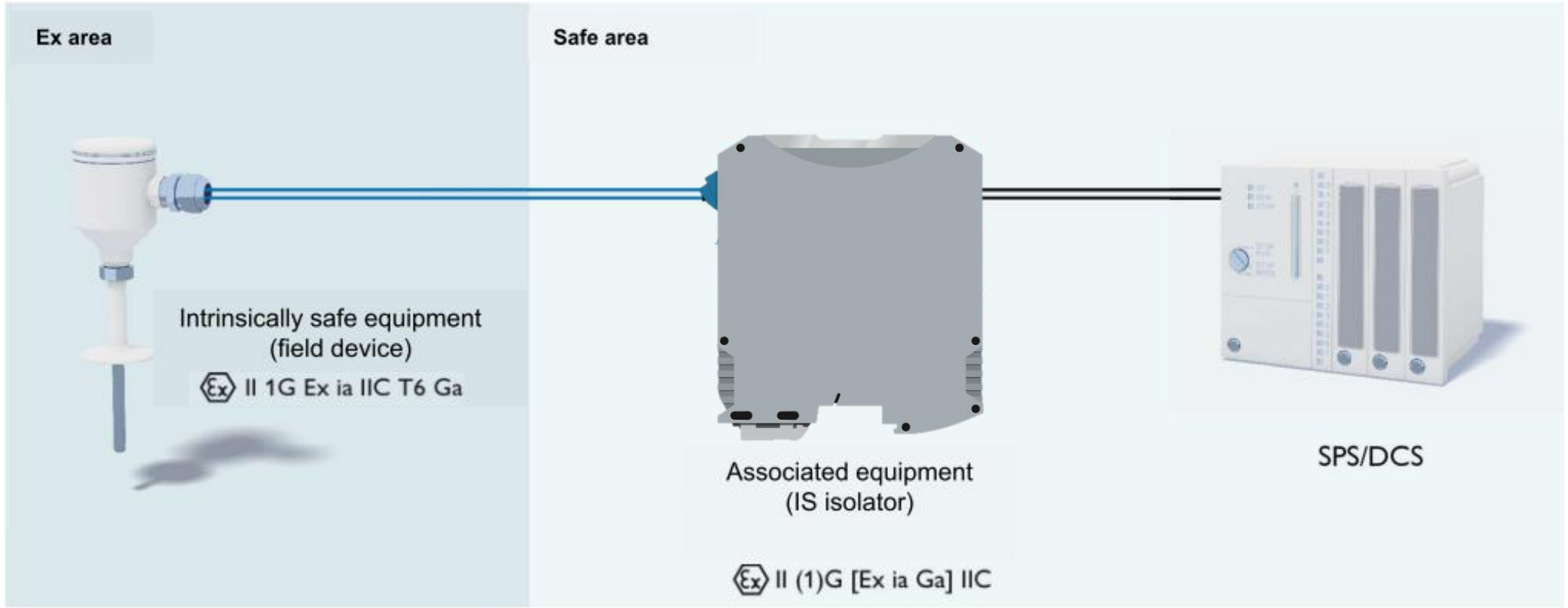
Ex i
Intrinsic Safety

Favorable/ Cost-Effective
- No Solid Housing Required (Example Ex d – Flame Prevented Enclosure)

Maintenance Under Voltage
- Safety “ Hot” Permits Not Required

Unique Type Of Protection
- Admissible only in Zone 0

Achieving Intrinsic Safety With Isolators



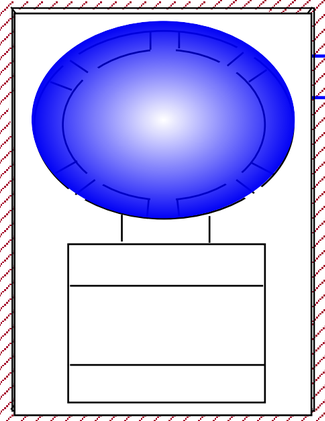
Proof Of Intrinsic Safety

U- Voltage
I- Current
P-Power

C- Capacitance
l- Inductance

EX-Area

Intrinsically safe field device



$U_i \geq U_o$

$I_i \geq I_o$

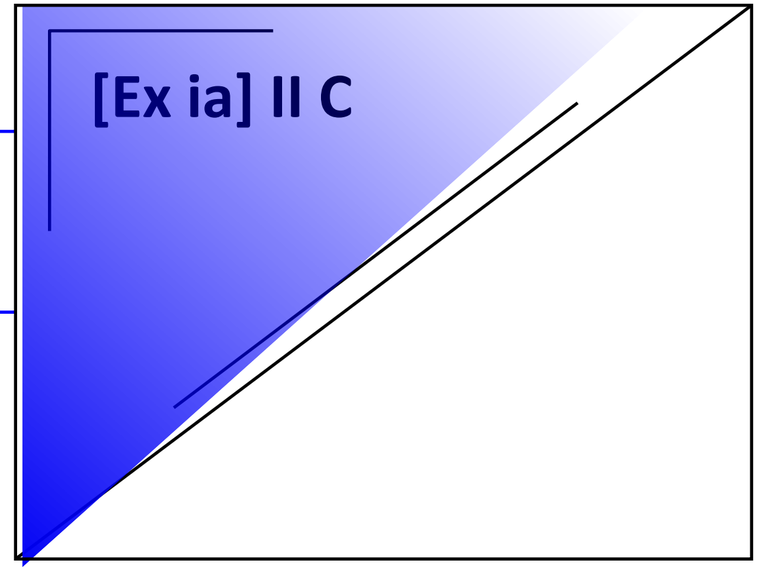
$P_i \geq P_o$

Connecting cables

$C_i + C_C$ cable $\leq C_o$

$L_i + L_C$ cable $\leq L_o$

Associated Apparatus

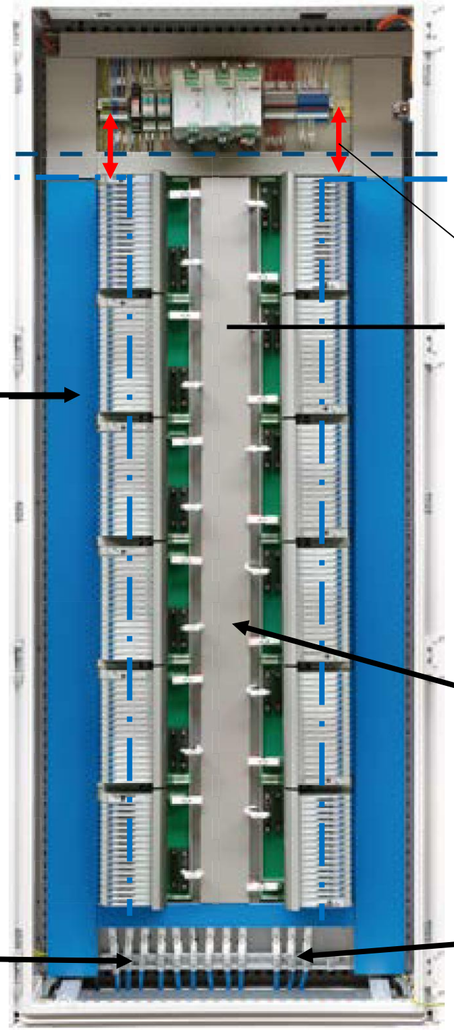


Interfacing Zone 0 Signals

Intrinsically safe circuit

- must be clear marked, (light blue / RAL 5012)

- separated cable ducts for intrinsically safe and non intrinsically safe signal cables / circuit



Distance between Ex i and non Ex i circuits ≥ 50 mm

Non intrinsically safe circuits to PLC / DCS

Grounding of conducting shields

Multicore cable (light blue) into the hazardous area / Ex zones

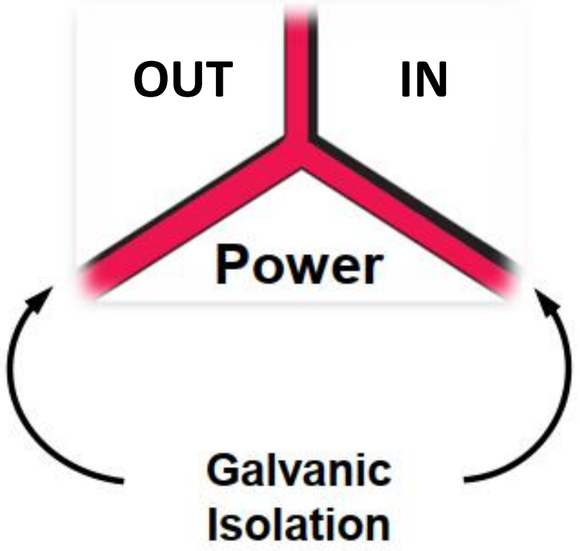
Signal Conditioning Overview

Field Instruments

Zones 0-2
or Non-Ex

Active/ Passive

Signal Conditioner



Non-Ex or Zone 2

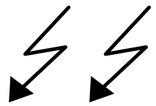
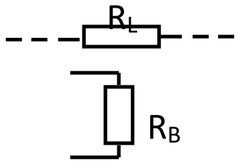
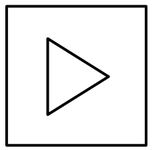
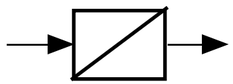
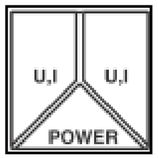
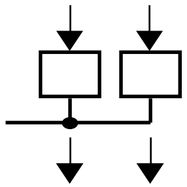
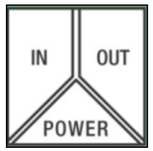
Active/ Passive

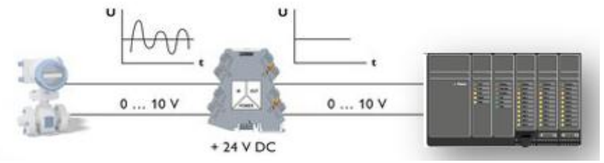
PLC/DCS

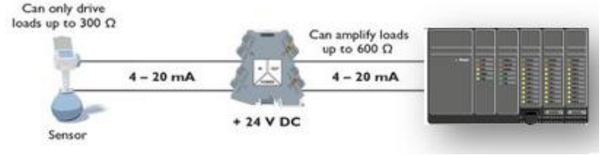
Digital/Analog Signals

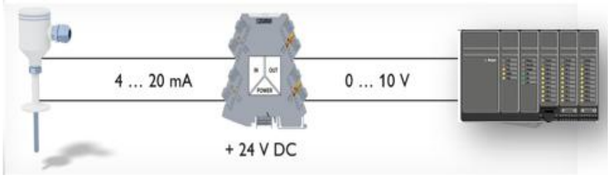
Non-Ex or Zone 2

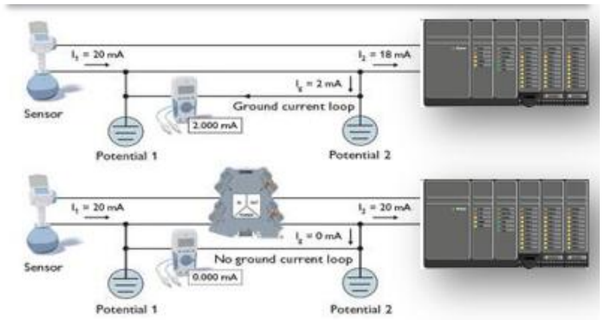
Purpose Of Signal Conditioning

Problem		Solution	
	Interferences		Signal filtering
	Long transmission lines High loads		Signal amplifying
	Various analog signals		Signal conversion
	Ground loops / Potentials differences		Galvanic isolation









Mini Analog Pro

Ex i

SIL3
IEC 61508

Analog & Digital IN/OUT

- Supports a Wide Range of Signals

12 The marking of the product shall include the following:

II (1)G [Ex ia Ga] IIC
II (1)D [Ex ia Da] IIIC
I (M1) [Ex ia Ma]
II 3(1)G Ex ec [ia Ga] IIC
T4 Gc

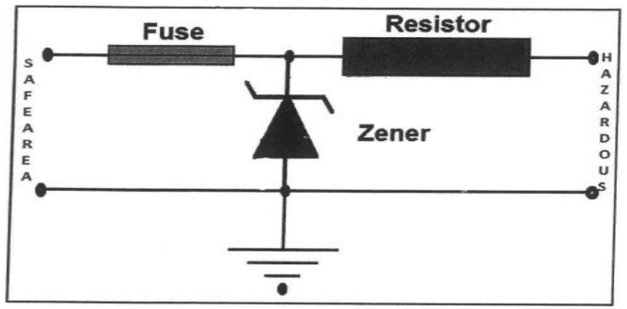
Intrinsically Safe Protection & Functional Safety

- ATEX & IECEx Certified
- Intrinsic Safety Ex I
- Highest Level of Functional Safety SIL 3 1oo1

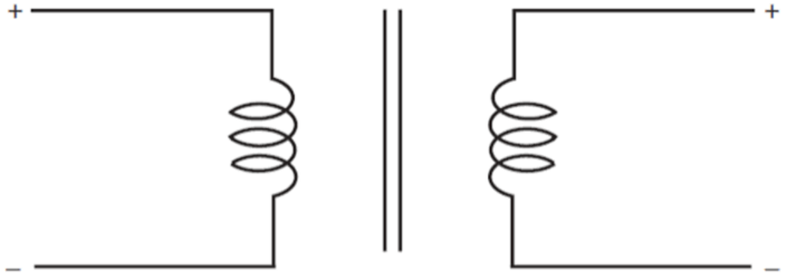
Mini Analog Pro

Features	Zener Barrier	Galvanic Isolator
Isolation Transformer	No	Yes
IS Earth	Yes	No
Signal Filtering	Moderate	Excellent
Technology	Zener	Transformer

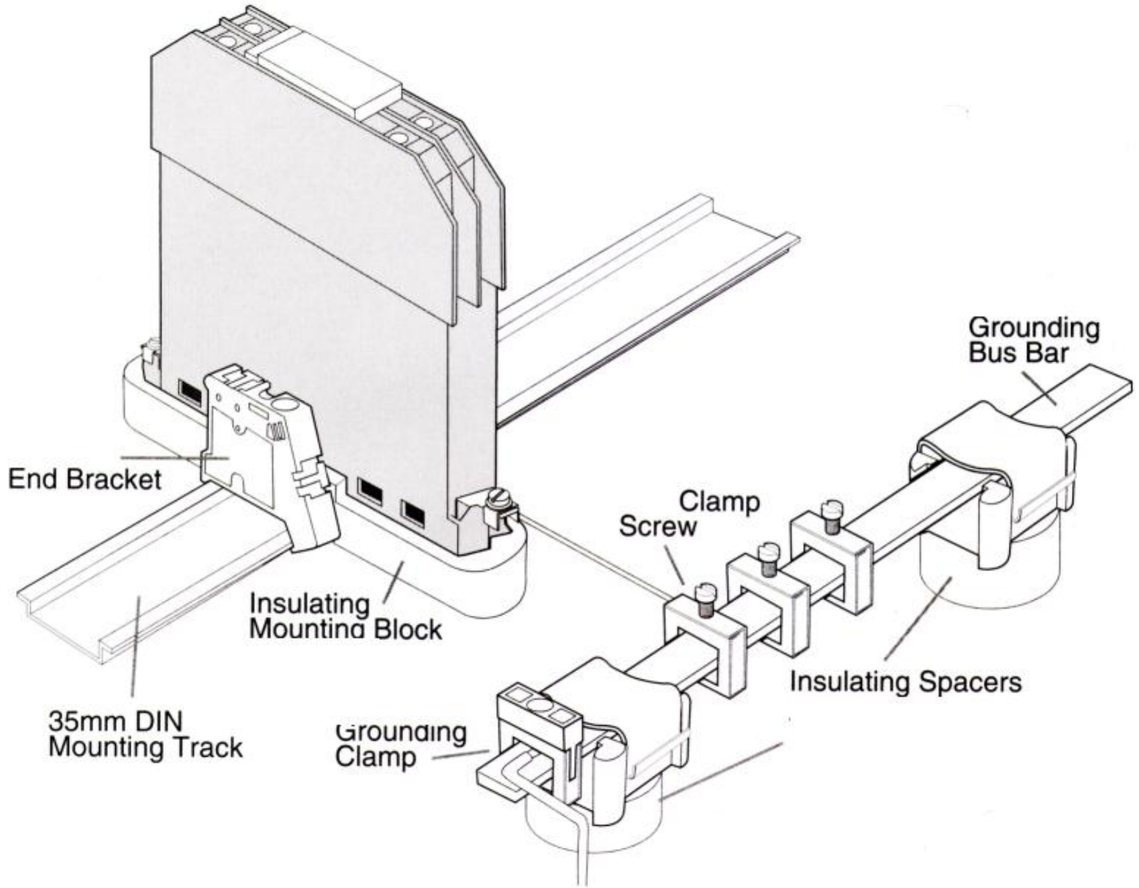
Zener Barrier



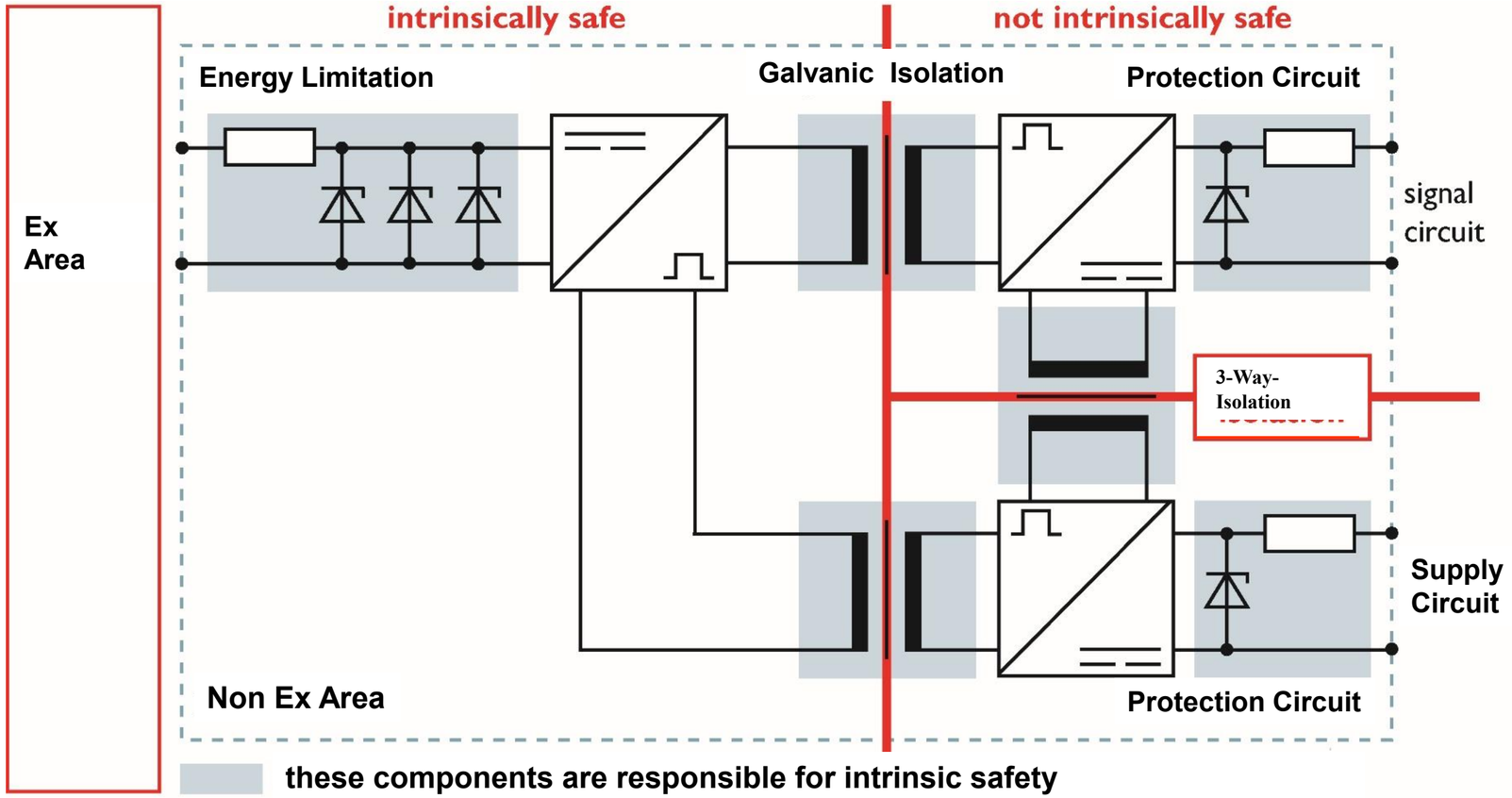
Galvanic Isolation

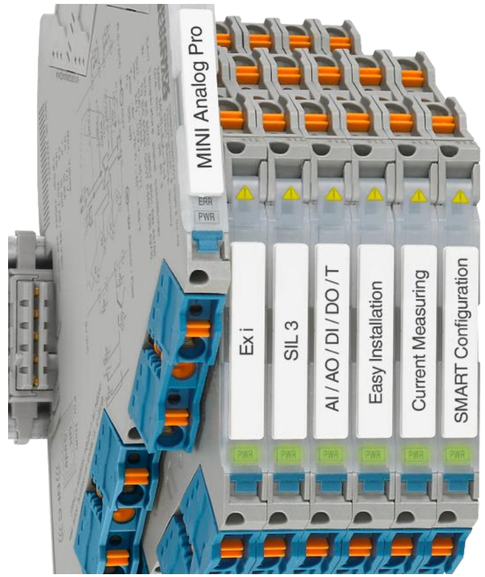


Zener Barrier Installation Example

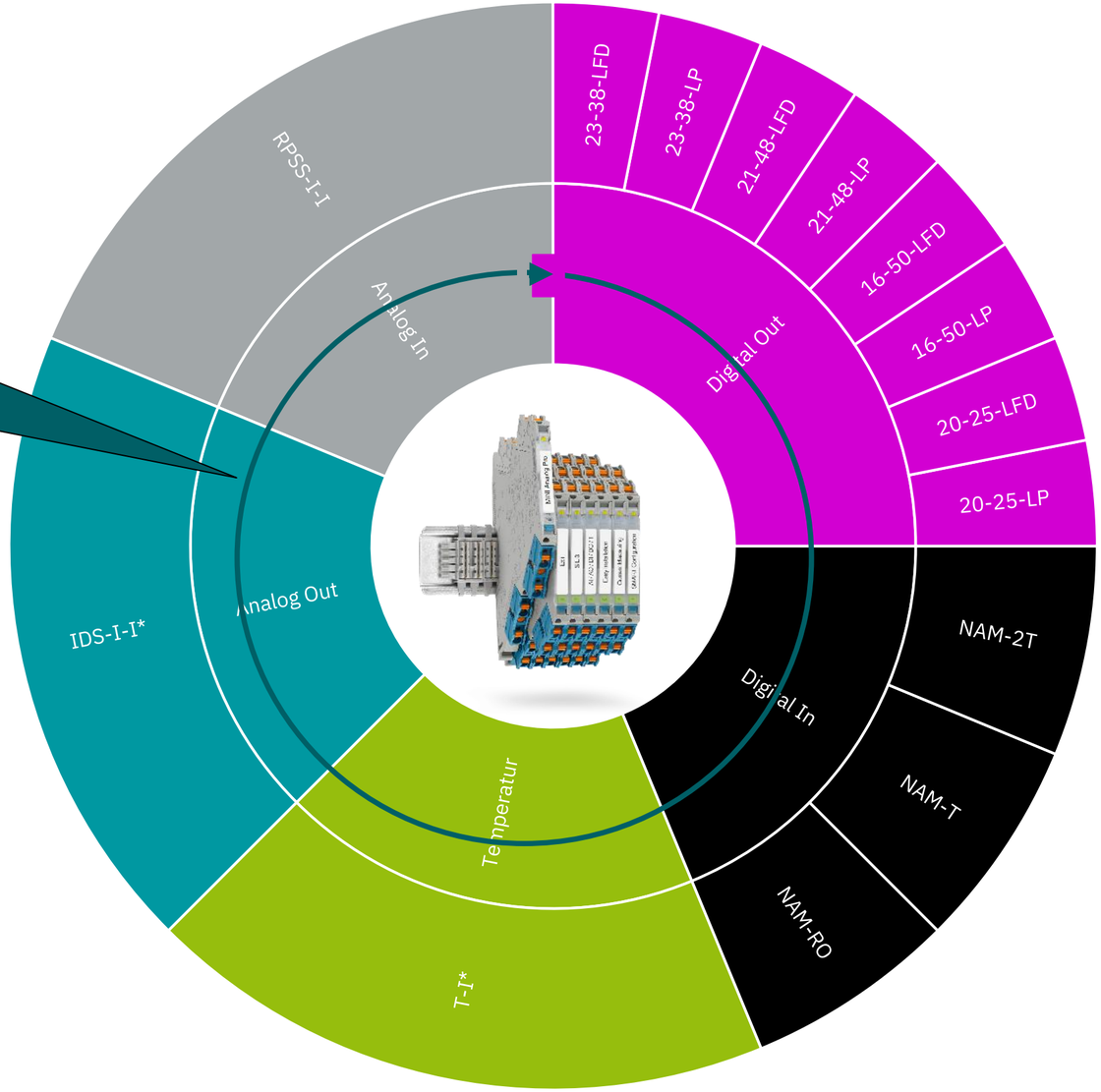


Intrinsic Safety



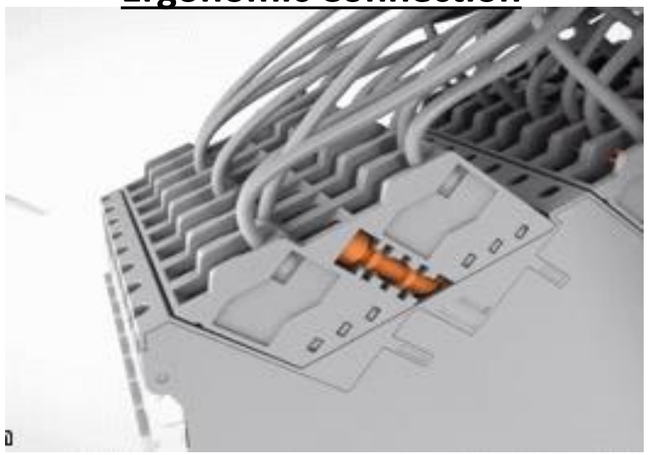


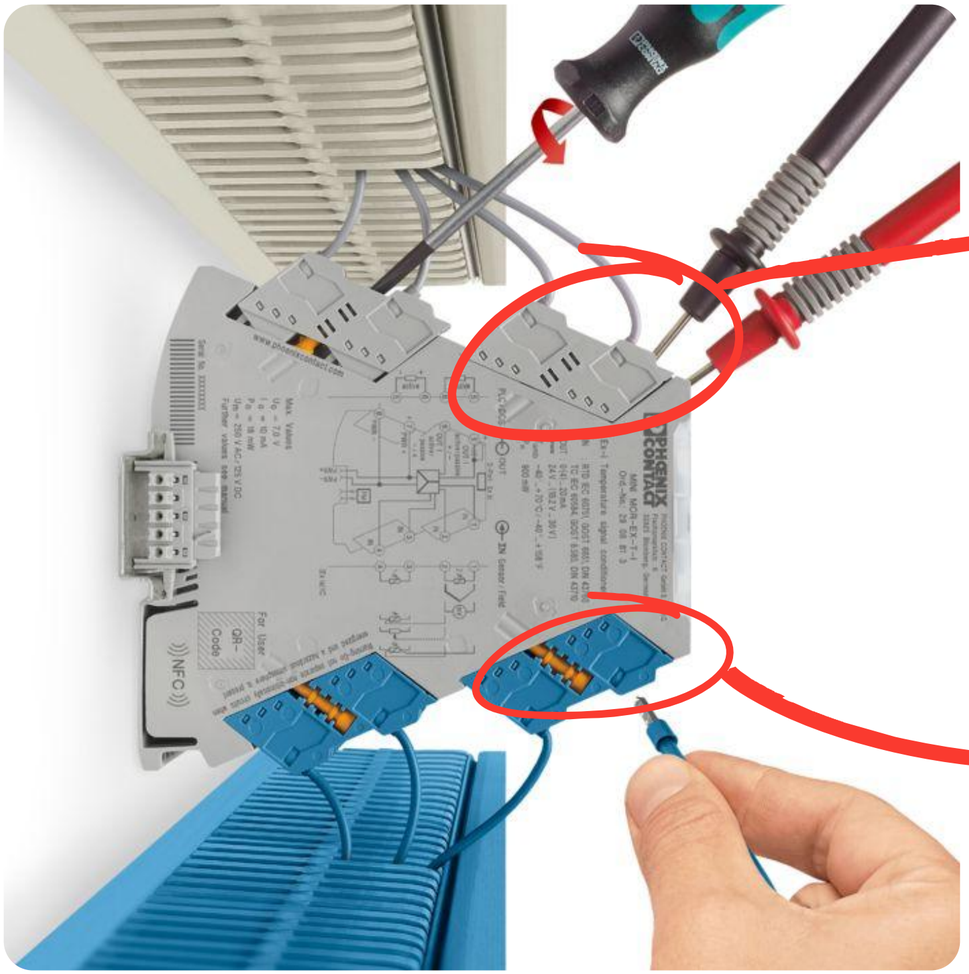
High-end core portfolio for all signal directions with SIL 3 1oo1



Uninterruptible Current Measurement

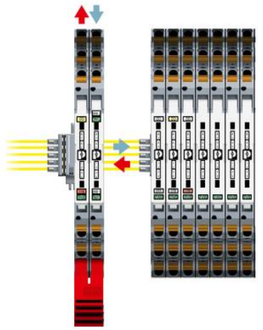
Ergonomic Connection





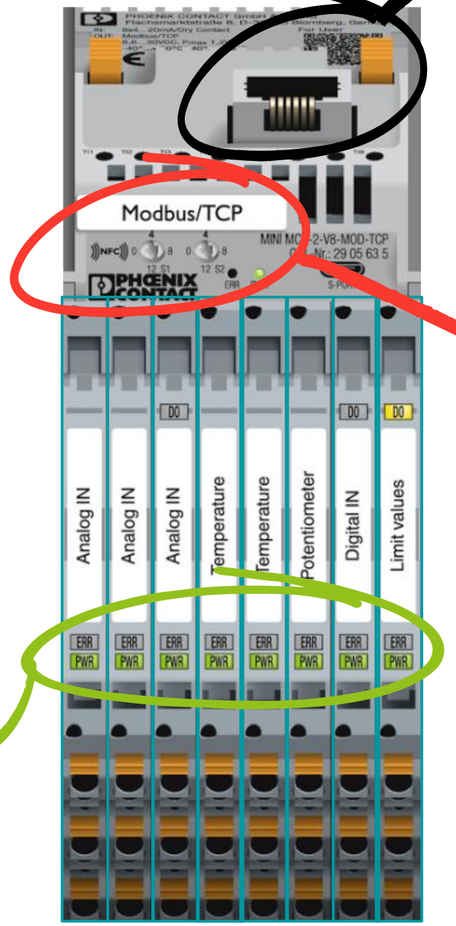
Digital Services & Configuration

Group Error Messaging



Save Space and Cost at the Control Level

Easy Startup & Service



Large-Surface Marking areas and status indication

Combine Up To 8 Signal Conditioners

Application Example

Offshore Wellhead Platform

Common Challenges Faced

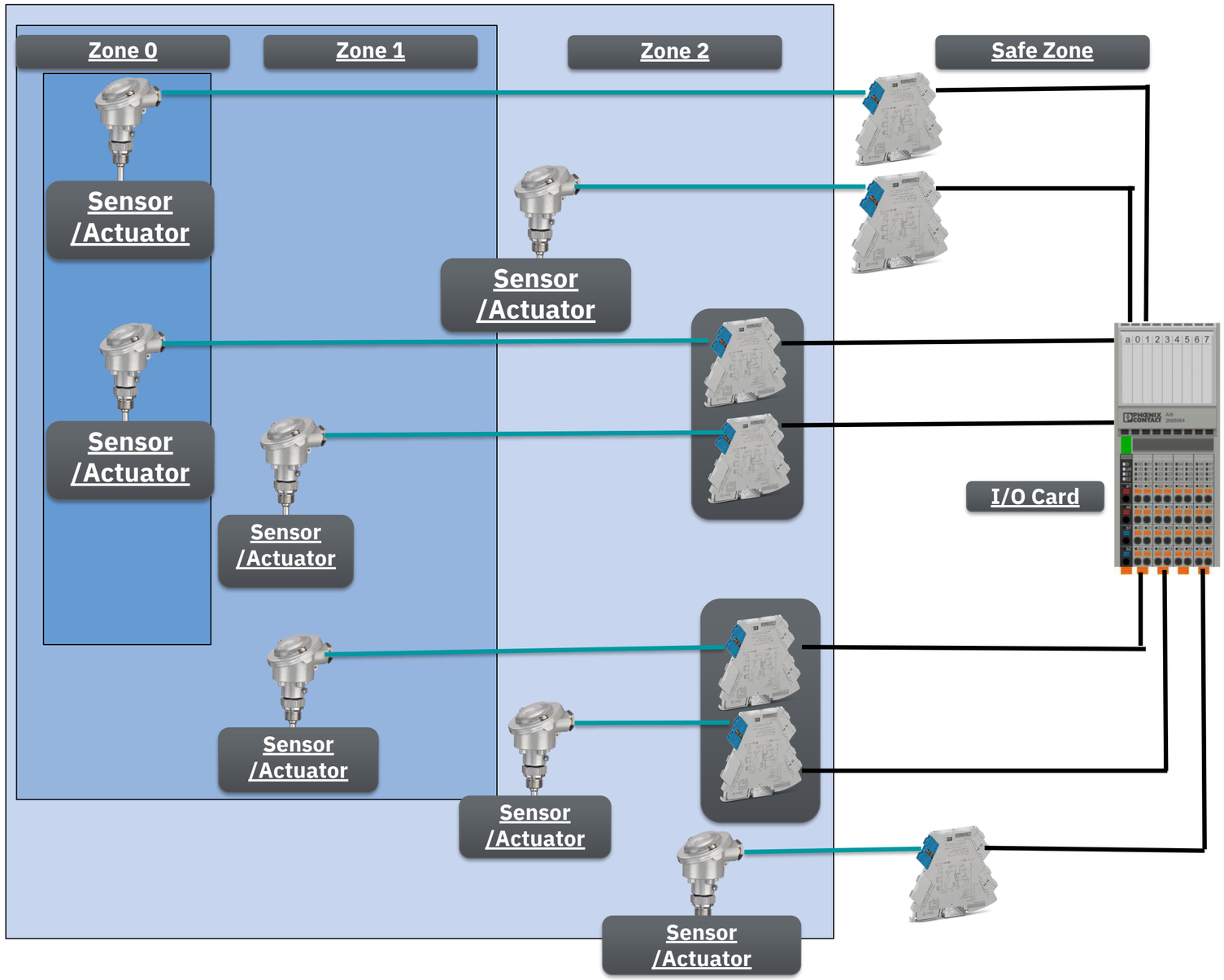
Space Constraints

Power Limitation

Heat

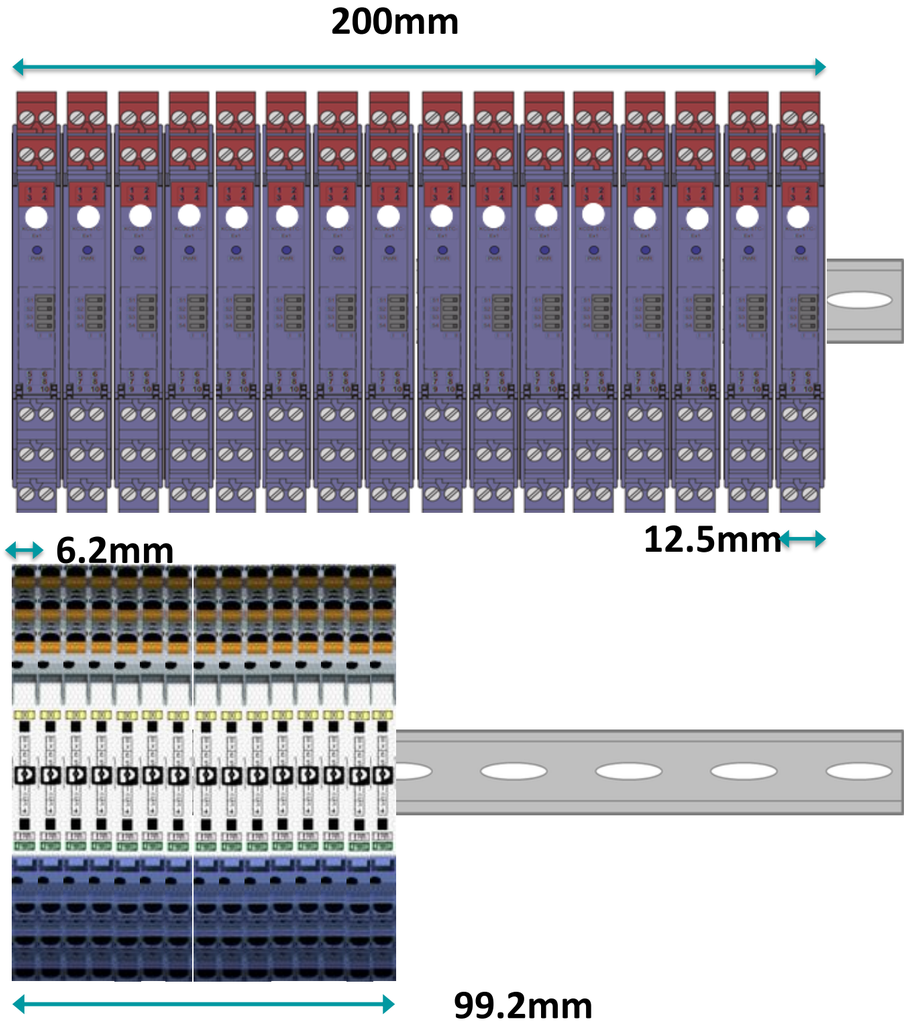
Space Constraints

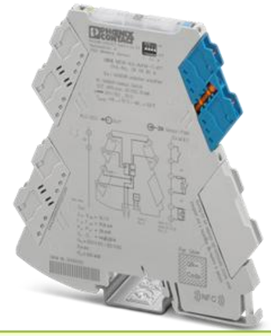
Offshore Wellhead Platform



Space Constraints

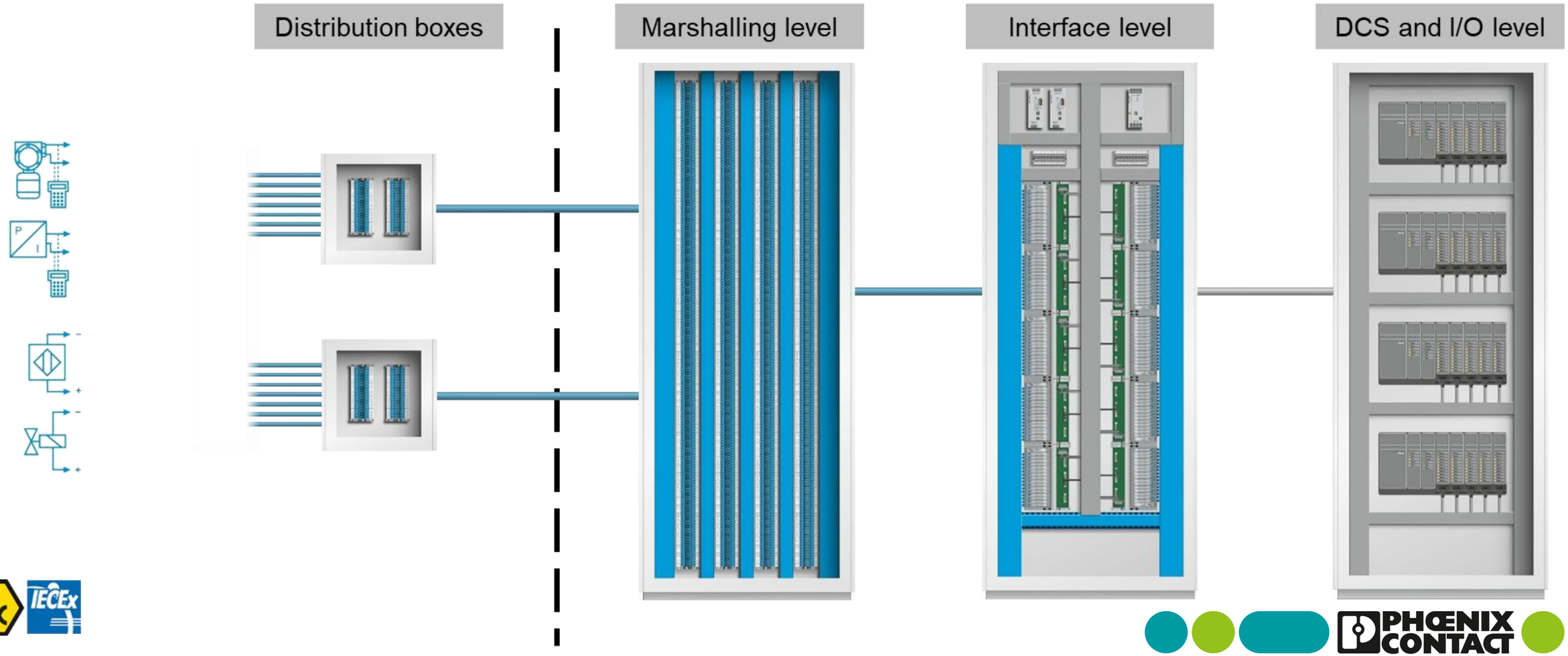
Offshore Wellhead Platform





Thinnest Signal Conditioner With SIL 3 and Ex Certification

Power Limitations & Heat



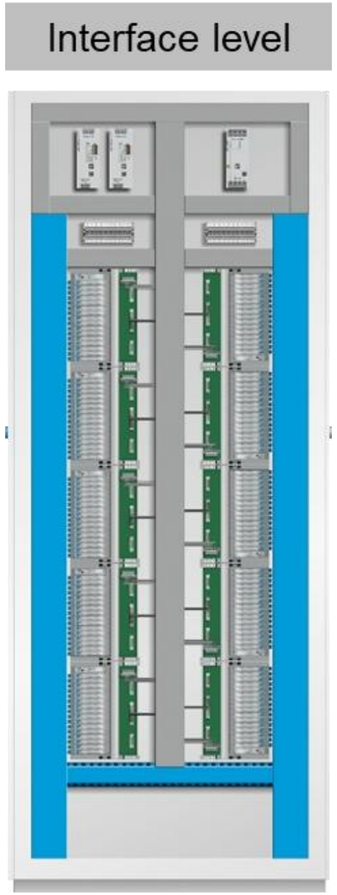
Power Limitations & Heat

Dangers of Overheating & High-Power Consumption

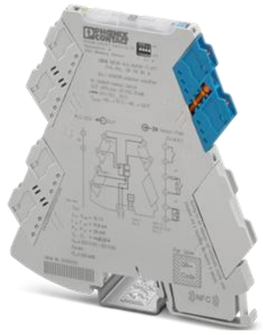
Limited Power

Equipment Damage
&
Reduced Lifespan

Fire Hazard



Power Limitations & Heat



Mini Analog Pro EX	Brand XY
1.2~1.4 W	1.7~1.9 W

Lower Power Consumption
- Difference Of 0.3-0.5W

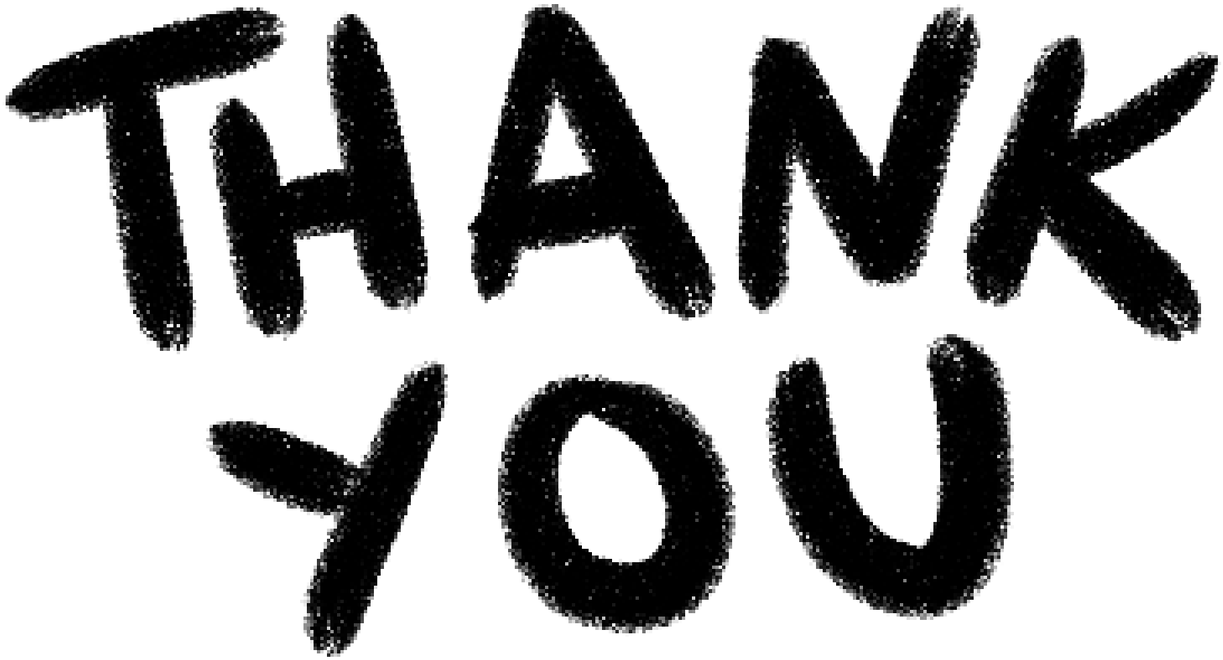
Small Per Channel, Large Total Heat Load
- Isolators in field: 200-400 AI,AO,DI & DO

Low Total Power Consumption
- Allowable Power Load to Control System 100-500W

Key Takeaways

With the MINI Analog Pro....

- **Easy Installation & Servicing**
- **Intelligent Configuration and Monitoring**
- **Quick and Error-Free System Cabling**
- **Isolation From Field To Control**


THANK
YOU

PHOENIX CONTACT SOUTHEAST ASIA

INSTITUTE OF INTEGRATED ELECTRICAL ENGINEERS 1975

SINGAPORE CHAPTER 2011

ENGINEERING *RESILIENCE*

Enabling Industries through Innovation